NASA SBIR/STTR Technologies

S1.04-8039 - High Efficiency Semiconductor Arrays for Hard X-Ray Imaging



PI: Leonard Cirignano Radiation Monitoring Devices, Inc. - Watertown, MA

Identification and Significance of Innovation

- Wide-field, hard X-ray coded-aperture imagers using high resolution semiconductor detectors will benefit from new materials offering higher efficiency and lower costs
- RMD is proposing TIBr semiconductor detectors for next generation instruments typified by ProtoEXIST and HREXI that seek to improve angular resolution, effective area, and energy resolution
- TIBr offers considerably higher efficiency and has demonstrated very good energy resolution in pixelated designs
- TIBr is an easy to grow material and binary compounds can offer better substrate uniformity

NASA SBIR/STTR Technologies *JBIR* \$1.04-8039 - High Efficiency Semiconductor Arrays for Hard X-ray Imaging PI: Leonard Cirignano Radiation Monitoring Devices, Inc. - Watertown, MA TIBr detector Identification and Significance of Innovation technology for Wide-field, hard X-ray coded-aperture imagers using high resolution semiconductor detectors will benefit from new materials offering highe semiconductor defectors will beinet from new materials öffering higher efficiency and fower costs.

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TIB is a replacement technology for small sofullilators in handheld and portable instruments e.g. personal radiation detectors, surgical probes Firm Contacts Leonard Cirignano
Radiation Monitoring Devices, Inc.
44 Hurfl Street
Waterflown, MA, 02472-4699
PHONE; (617) 688-6810
FAX. (617) 688-6890 NON-PROPRIETARY DATA

Estimated TRL at beginning and end of contract: (Begin: 3 End: 4)

Technical Objectives and Work Plan

- RMD will work with the ProtoEXIST group at Harvard University to evaluate pixelated TIBr detectors
- RMD will fabricate 5 mm thick TIBr detectors as 600 μm pitch arrays and up to 20 x 20 mm area
- Detectors will be hybridized to H0 ASIC chips using polymer epoxy processes, similar to that done with CZT
- Detectors will be tested for radiation damage induced by proton beams
- Harvard will evaluate hybridized arrays for spectroscopy, depth corrections, distortions

NASA Applications

- TIBr is an option for next generation hard X-ray telescopes in Medium Class Explorer (MIDEX) missions
- Optimal for extending the energy range of large monolithic detector arrays

Non-NASA Applications

- TIBr is being developed for homeland security applications requiring good energy resolution for isotope ID and compact instrument formats
- TIBr is candidate for nuclear medicine imaging offering increased photofractions and less Compton scattering
- TIBr is a replacement technology for small scintillators in handheld and portable instruments e.g. personal radiation detectors, surgical probes

Firm Contacts Jennifer Carey

Radiation Monitoring Devices, Inc.

44 Hunt Street

Watertown, MA, 02472-4699 PHONE: (617) 668-6801 FAX: (617) 668-6890

NON-PROPRIETARY DATA